NON-LINEAR THERMAL LENS SIGNAL OF THE ($\Delta\upsilon = 6$) C-H VIBRATIONAL OVERTONE OF BENZENE IN LIQUID SOLUTIONS OF HEXANE

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The thermal lens technique is applied to vibrational overtone spectroscopy of solutions of benzene. The pump and probe thermal lens technique has been found to be very sensitive for detecting samples of low concentration in transparent solvents. The C-H fifth vibrational ($\Delta\upsilon = 6$) overtone spectrum of benzene is detected at room temperature for compositions per volume in the range (1 to 1×10^{-4}) using n-C_6H_{14} as the solvent. By detecting the absorption band in a 100 ppm solution, the peak absorption of the signal is approximately $(2.2 \pm 0.3)\times10^{-7}$ cm^{-1}. The parameters that determine the magnitude of the thermal lens signal such as the pump laser power and the thermodynamic properties of the solvent and solute are discussed. A plot of normalized integrated intensity as a function of composition of benzene in solution reveals a non-linear behavior. The non-linearity cannot be explained assuming solvent enhancement at low concentrations. A two color absorption model that includes the simultaneous absorption of the pump and probe lasers could explain the enhanced magnitude and the non-linear behavior of the thermal lens signal for solutions of composition below 0.01.